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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/050,334	01/15/2002	Vishnu K. Agarwal	MI22-1913	7861

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EXAMINER

HUYNH, YENNHU B

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 05/23/2003

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Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/050,334

Applicant(s)

AGARWAL ET AL.

Examiner

Yennhu B Huynh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 19 March 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 16-29 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 16-29 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 12 & 10
- 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

This Office Action is in response to the RCE filed on 3/19/03.

### *Specification*

The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: Capacitor Construction With Enhanced Surface Area Having Both Inner and Outer Surface Per Unit Area Greater Than Outer Surface Per Unit Area Of Substrate.

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in-

(1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or

(2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

Claims 16 & 17 are rejected under 35 U.S.C. 102(e) as being anticipated by Agarwal et al. (2003/0003697A1/ 09/590795).

-Re. claim 16: a surface area enhancement layer 22/16 over a substrate 10, the enhancement layer having an outer surface area per unit area that is greater than an

inner surface area per unit area of the enhancement layer (figs. 4-7, page 3 [0046-0048]); a first capacitor electrode layer 26 over the enhancement layer, the first electrode having an inner surface area per unit area and an outer surface area per unit area that are both greater than an outer surface area per unit area of the substrate, and the first electrode not comprising the enhancement layer; a capacitor dielectric layer 28 over the first electrode and a second capacitor electrode 30 over the dielectric layer (p.4, [0049, 0050]).

-Re. claim 17: wherein the first electrode comprises TiN (p.5, [0057]).

Claims 22 & 24-26 are rejected under 35 U.S.C. 102(b) as being anticipated by Fukuzumi et al. (U.S. 6,222,722).

Fukuzumi et al at figs. 1-40 in col. 1-12 disclose a capacitor having undulated lower electrode, which include:

-Re. claim 22: an opening 22 in an insulative layer 21 over substrate 2, the opening having sides and a bottom (figs. 1-4); a HSG polysilicon layer 23 over the sides of the opening but not over the bottom (figs. 18-20, p.7, [0108-0111]); a conformal first capacitor electrode 24, the first electrode being sufficiently thin that the first electrode has a rugged outer surface with an outer surface area per unit area greater than an outer surface area per unit area of the substrate underlying the first electrode; a capacitor dielectric layer 26 on the first electrode and a second capacitor electrode layer 27 over the first dielectric (fig. 22, p.7, [0112,0113]).

- Re. claim 24: wherein the polysilicon comprises spaced apart grains (fig. 20).
- Re. claim 25: wherein the first electrode comprises TiN (p.5, [0057]).
- Re. claim 26: wherein the dielectric layer comprises Ta<sub>2</sub>O<sub>5</sub>, ZrO<sub>2</sub>, BST, HfO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub> or ST (p.4, [0056]).

Claims 27-29 are rejected under 35 U.S.C. 102(b) as being anticipated by Fukuzumi et al. (U.S. 6,222,722).

-Re. claim 27: a surface area enhancement layer comprising undoped rugged polysilicon 51 over a substrate 2, the enhancement layer having an outer surface area per unit area that is greater than an inner surface area per unit area of the enhancement layer; a first electrode layer 52 on an in direct contact with the enhancement layer but not comprising the enhancement layer as part of the first electrode, the first electrode having an inner surface area per unit area and an outer surface area per unit area that are both greater than the inner surface area per unit area of the enhancement layer; a capacitor dielectric layer 53 and an upper capacitor electrode 54 over the dielectric layer (figs. 30-34, p.8, [0135-0137]).

-Re. claim 28: an opening 22 in an insulative layer 21 over substrate 2, the opening having sides and a bottom (figs. 1-4); a HSG polysilicon layer 23 over the sides of the opening but not over the bottom (figs. 18-20, p.7, [0108-0111]); a conformal first capacitor electrode on the polysilicon, the first electrode being sufficiently thin that the first electrode has a rugged outer surface with an outer surface area per unit area greater than an outer surface area per unit area of the substrate underlying the first

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electrode ; a capacitor dielectric layer and a second capacitor electrode layer 27 over the first dielectric (p.2, [0025]).

-Re. claim 29: wherein the first electrode also has an inner surface area per unit area that is greater than the surface area per unit area of the sides of the opening area (fig.20).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 18-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Agarwal et al. (U.S.2003/0003697A1) in view of Fukuzumi et al. (U.S. 6,222,722) and Rhodes et al. (U.S. 6,291,289B2).

Agarwal et al. disclose substantially all of claimed invention, except wherein the enhancement layer comprises rugged polysilicon over the substrate (cl. 18); the rugged polysilicon in undoped polysilicon (cl. 19), the polysilicon comprises spaced apart grains (cl. 20), and the outer surface area of the first electrode is at least 30% greater than the substrate outer surface area (cl.21).

Fukuzumi et al. disclose a capacitor having undulated lower electrode, which include:

-Re. claim 18: wherein the enhancement layer comprises rugged polysilicon layer 4 over the substrate and the first electrode layer 7 being over the rugged polysilicon (p.4, [[0075], fig.3).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the invention of Agarwal et al. by positioning the first electrode layer being over the rugged polysilicon substrate, to increase the capacitance area in a small cell area.

Rhodes et al. disclose integrated circuitry capacitor, which include :

-Re. claim 19: wherein the enhancement layer comprises undoped rugged polysilicon (col.1 ,lines 27-38 and col. 4, lines 37-41).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the invention of Agarwal et al. by incorporating the undoped rugged polysilicon to obtain a lesser degree of doping and reducing the dopant migration into other substrate structure.

-Re. claim 20: wherein the rugged polysilicon comprises spaced apart grains for a greater outer surface is showing by a less closely position grains(fig.7).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the invention of Agarwal et al. by incorporating the rugged polysilicon comprises spaced apart grains, to obtain a greater outer surface.

With respect to claim 21, the range of thickness, pressure, energy, dimension or concentration is considered to involve routine optimization while has been held to be within the level of ordinary skill in the art, As noted In re Aller 105 USPQ233, 255 (CCPA 1955)., the selection of reaction parameters such as temperature and concentration would have been obvious.

"Normally, it is to expected that a change in temperature, or in range, concentration, cycles, thickness, would be an unpatentable modification. Under some circumstance, however, changes such as these may be impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art ... such ranges are termed "critical ranges and the applicant has the burden of proving such criticality ... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller 105 USPQ233, 255 (CCPA 1955). See also In re Waite 77 USPQ 586 (CCPA 1948); In re Scherl 70 USPQ 204 (CCPA 1946); In re Irmischer 66 USPQ 314 (CCPA 1945); In re Norman 66 USPQ 308 USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).

Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fukuzumi et al. (U.S. 6,222,722) in view of Rhodes et al. (U.S. 6,291,289B2).

Fukuzumi et al. disclose substantially all of claimed invention, except wherein the polysilicon is undoped (cl. 23).

Rhodes et al. disclose integrated circuitry capacitor, which include :

-Re. claim 23: wherein the polysilicon is undoped (figs. col.4, lines 24-41).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the invention of Fukuzumi et al. by incorporating the



undoped rugged polysilicon to obtain a lesser degree of doping and reducing the dopant migration into other substrate structure.

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yennhu B. Huynh whose telephone number is 703-308-6110. The examiner can normally be reached on M-F 8.30AM-7.00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached 703-308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

YNBH,  
5/2/03

  
CARL WHITEHEAD, JR.  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2800